

REMARKS

The specification has been amended to correct errors of a typographical and grammatical nature. Due to the number of corrections thereto, applicants submit herewith a Substitute Specification, along with a marked-up copy of the original specification for the Examiner's convenience. The substitute specification includes the changes as shown in the marked-up copy and includes no new matter. Therefore, entry of the Substitute Specification is respectfully requested.

The abstract has also been amended to more clearly describe the features of the present invention.

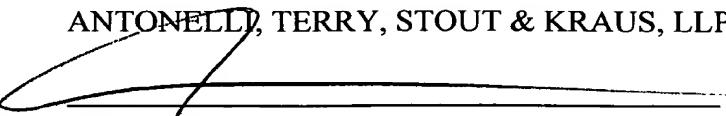
Also submitted herewith is a proposed amendment to the drawings, wherein Figs. 17, 21, 25 and 29 have been amended at this time. Upon receipt of the approval of the amendment to the drawings and receipt of a Notice of Allowance, the proposed drawing corrections will be effected in accordance with present practice.

Entry of the preliminary amendments and examination of the application is respectfully requested.

To the extent necessary, applicant's petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 01-2135 (503.39690X00) and please credit any excess fees to such deposit account.

Respectfully submitted,

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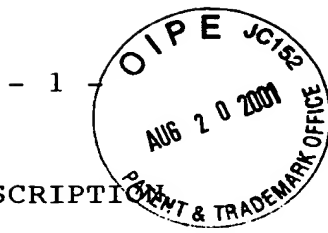
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ABSTRACT

~~Disclosed is a~~ A pen type input device with a camera ~~which is~~ has improved usability, ~~by~~
~~improving~~ as a result in improved construction of the device. The pen type input device with the
camera is ~~construction-adapting~~ adapted for use in detecting both of a horizontally elongated
object and a vertically elongated object. On the other hand, means for pointing to the object and
the process content simultaneously, and further means for detecting the fact that the user is
pointing to the object in an erroneous manner and for teaching a correct manner of ~~teaching of~~
pointing to the object depending thereon are provided.

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DESCRIPTION

PEN TYPE INPUT DEVICE WITH CAMERA

TECHNICAL FIELD

5 The present invention relates to a pen type input device^{provided},
with a camera^{that has an} [with] improved usability. More particularly, the
invention relates to a pen type input device ^{for use} [employing], as a
user interface, ^a permitting a user to easily call out function
of an information processing apparatus. Namely, the invention
10 relates to ^a handy image input device to be used ^{with an} [in the] information
processing apparatus.

BACKGROUND [ART] OF THE INVENTION

15 ^{An example of} [As a prior art relating to] a pen type input device with
a camera, ^{called} [there is] a MEMO-PEN^{, is} disclosed in ACM PRESS, HUMAN
FACTORS IN COMPUTING SYSTEMS, CHI 95 Conference Companion, p256
- P257. The MEMO-PEN ^{is} incorporates a compact camera embedded
in a penholder to continuously pick-up ^{an} image in the vicinity
of a penpoint across the penpoint to record ^a handwriting. ^[An] ^{by}
^{in which data can} 20 area ^{to} be picked-up by the camera of the MEMO-PEN is limited
to a quite narrow region required for making ^a judgment ^{as to the} [of] direction
of ^{the} handwriting.

25 In the MEMO-PEN, since the camera is embedded in the
penholder, ^{the} [a] visual field of the camera is ^{obstructed} [interfered] by ^{the} [a] hand
of the user, unless ^{the} [an] optical system ^{is} [has to be] arranged at a
position inclined toward the penpoint from a portion ^{of the penholder} to be gripped

by the hand of the user. Therefore, even if ^{an} [the] optical system ^{to the} having wide visual field is used, there is a limitation [of] ^{at which} distance ^{can be spaced} to place the optical system ^{to be viewed} [away] from an object, (paper).

Therefore, the wide visual field of the camera cannot be ^{used efficiently} 5 [established]. On the other hand, in the condition ^{in which} [where] the user naturally holds the pen, the penholder is usually inclined ^{relative to an} significantly [from] up-right position. Therefore, an image to be picked up by the camera is a cross shot of the image.

A function of the MEMO-PEN is to store the handwriting 10 of the user written by the MEMO-PEN, ^{so as} to ^{allow} [reproduce] the handwriting, ^{to be reproduced} ^{with} ^{an} [under] the aid of [some] information processing apparatus or to ^{the written} recognize characters. Namely, during collection of the handwriting data, in other words, while the user uses the MEMO-PEN, ^{which is provided} a user interface, to call out the function of the information 15 processing apparatus, using ^a [the] pen-type input device with ^{the} [the] camera, would never be executed. Accordingly, ^{the} a kind of process to be applied for processing ^{of data} the object (handwriting) during input, is not designated by the pen. Furthermore, in case of the MEMO-PEN, since the pen pointer and the position of the 20 handwriting constantly match ^{the} [with] each other, it is not necessary to adjust ^{the} positional relationship between input object (handwriting) and the penpoint.

^{an example of a system} As ^a [the] prior art relating to ^a [the] pen-type input device with ^{is} ^a [the] camera, [there is] a system called [as] PaperLink disclosed 25 in ACM PRESS, HUMAN FACTORS IN COMPUTING SYSTEMS, CHI 97 CONFERENCE PROCEEDINGS, P327 - p334. In the PaperLink, ^{system} (as a) ^{the}

device with which the user inputs a process object^{is}, a pen-type input device mounting a compact camera. The compact camera is located at a position looking down^{on} the object (paper surface) from right above^{under} ^{in which} the condition^{where} the user naturally holds the pen. The visual field of the camera can be set so that^{the camera views} an area of several cm square around the penpoint. The picked-up image around the penpoint is input to the information processing apparatus to execute various processes depending upon the^{data} content. If the input object is known, ^a the predetermined process depending thereupon is executed. For example, ^a predetermined file is opened [to present] to the user or execution of [the] ^a predetermined program is initiated. On the other hand, if the [input] ^{being input} object^{is} is not known, it is temporarily stored^{for use} [to be used] as an argument to ^a [the] command to be executed later.

15 A problem to be solved by the present invention is ^(to) ^{that the} ^{degraded} usability ^{of} in the device for inputting ^{an image of} an object ^{is degraded} ^(using) ^(an image) by ^{mounting} [loading] the compact camera on the pen-type device.

[Another problem] In the MEMO-PEN, since the camera including the optical system is built in the penholder, ^{there is another problem in that} it is difficult to provide^a wide visual field for the camera.

Concerning the foregoing PaperLink^{system}, since ^{the} ^{axis of the} ^{plane} ^{observed} [an] axis of the pen and center axis of the camera are arranged on the same ^{plane} [plain], ^a longitudinally elongated pattern cannot be ^{observed} [pointed] by natural operation.

25 Furthermore, in the input device of the PaperLink^{system}, since ^{there is only one} ^{to} means for pointing the object [is only one kind], it [cannot be] ^{is not}

possible to designate the process object and kind of process simultaneously.

Also, if the user ^{designates an} ~~makes designation~~ object and the penpoint ^{has a} ~~in the~~ construction ^{such that} ~~where~~ the camera looks down the penpoint ^{system} ~~from the~~ above, as in the PaperLink, the ^{designated} ~~designation~~ object is hidden by the penpoint, ^{thereby} ~~to make it impossible to~~ ^{produce an} ~~make~~ accurate input.

On the other hand, since the penpoint and the ^{designated} ~~designation~~ object cannot be overlapped, as set forth above, it becomes ^{limit the choice} necessary to ~~reflect favor~~ of the user in the method for designating the object. Namely, in the pen-type input device with ^a ~~the~~ camera, ^{the} ~~a~~ relationship between the position of the ^{designated} ~~designation~~ object and the position of the penpoint is variable depending upon ^{the choice} ~~favor~~ of designation method of the user. For example, when the user designates a laterally elongated object, some users may point ^{to} ~~the~~ center portion, and another user may point ^{to a} ~~lower right~~ position. On the other hand, ^{the} ~~tilt~~ angle of the pen upon pointing ^{to} ~~the~~ object may be ^{different with} ~~variable at~~ different users.

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^{SUMMARY} [DISCLOSURE] OF THE INVENTION

An object of the present invention is to provide a pen type input device with a camera which can improve ^{the} ~~usability~~ ^{of the input device}.

In order to accomplish the foregoing object, the present invention is provided with the following ^{features} ~~(means)~~.

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^{avoidance with}
In the present invention, upon installing the camera on

the pen, ^{the} [a] center axis of the camera is arranged ^{to be} offset ~~from~~ from ^{the} [a] center of the pen. When a user points ^{to} a vertically elongated object from ^{the} right side, the camera is arranged at ^{the} left side ^{of the} [than] a penholder. ^{by way} (By) this, the penholder will never be placed between the camera and the object, ^{so as to produce an obstruction} [to be hindrance].

Conversely, ^{to} when a user points ^{the} a vertically elongated object from ^{the} left side, the camera is arranged at ^{the} right side ^{of the} [than] a penholder. On the other hand, in place of fixing the camera ^{to be} offset ~~from~~ toward ^{the} left or ^{the} right, ^{adopted} a construction may be ^{by} [taken] ^{the camera} to offset ^{the} toward left or right ^{to either side} [with] pivoting the camera ^{to} [toward] [left and right] within a range from 0° to 90° .

On the other hand, a compact camera, or a portion of the ^{on which the camera is} pen ^{the} installed, ^{the same} [the same] is provided with a process designating device for designating ^{the} a kind of process to be ^{employed} [applied] for the ^{data obtained from the} [pointed] object. The process designating device may be a mechanism for switching ^{the} a color of penpoint in a multi-color ball point pen, for example. By preliminarily setting a predetermined process ^{using} [by] the process designating device, the process can be activated simultaneously ^{while} [with] pointing ^{to} [of] the process object. The process designating device may be a device ^{for} for varying ^{the} shape or color of the penpoint. Since the penpoint is ^{used} ^{to} for pointing ^{to} the object, the user may watch the shape or color of the penpoint corresponding to the kind ^{of} [of] process ^{while} [with] capturing the ^a [pointing] object in a visual field.

On the other hand, ^a pointing manner teaching means for teaching ^{the} correct manner of pointing ^{to} [for] the user is provided,

and incorrect pointing detection means for detecting ^{an} incorrect manner of pointing of the object ^{by} ~~(of)~~ the user is provided. The incorrect pointing detection means may make ^a judgment ^{as to the} ~~(of)~~ incorrect manner of pointing of the object by the user when
5 a region of the detected object and a region where the penpoint appears overlap, for example. On the other hand, when extraction of the object ^{has} failed continuously for a predetermined ^{number of} times, judgment may be made that ^{the} manner of pointing the object ^{by} ~~(of)~~ the user is not correct.

10 Furthermore, in order to ^{give the user a choice in} ~~(set the favor upon)~~ pointing, the object using the pen type input device with ^a ~~(the)~~ camera ~~(by the)~~ ~~(use)~~, pointing error correcting means may be provided. The pointing error correcting means is different from ^{the} parallax error means ^{provided} in a typical tablet display, and is means for
15 registering ^{a choice or preference} ~~(favor)~~ of the user concerning ^{the} positional relationship between the pen type input device with ^a ~~(the)~~ camera and the object pointed ^{to} ~~(by)~~ the same.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Fig. 1 is ^{a diagram} ~~(an)~~ illustration showing a construction of an overall system employing a video pen according to the present invention;

Fig. 2 is ^{a diagram} ~~(an)~~ illustration showing ^{details} ~~(a)~~ construction of the video pen;

Fig. 3 is ^{a diagram} ~~(an)~~ illustration showing the video pen as viewed
25 from ~~(the)~~ above;

Fig. 4 is ^{a diagram} ~~(an)~~ illustration showing one example of an image

picked-upⁱⁿ a ^{line of a} [line in a] horizontal [writing] document by means of a video pen;

Fig. 5 is ^{a diagram} [an illustration] showing one example of an image picked-upⁱⁿ a ^{line of a} [line in a] vertical, [writing] document by means of
5 a video pen;

Fig. 6 is ^{a diagram} [an illustration] showing a construction of the video pen for left-handed ^{use} as viewed from [the] above;

Fig. 7 is ^{a diagram illustrating the} [an illustration for] quantative [discussion for] shifting amount of the camera of the video pen;

Fig. 8 is ^{a diagram} [an illustration] showing an example of ^{the} (a) shape of a penpoint requiring ^{an} extremely small shifting amount of the camera of the video pen;

Fig. 9 is ^{diagram} [an illustration] showing a construction of the video pen;

Fig. 10 is ^{a diagram} [an illustration] showing a video pen as viewed from [the] above (setting for horizontal writing);

Fig. 11 is ^{a diagram} [an illustration] showing a video pen as viewed from [the] above (setting for vertical writing);

Fig. 12 is ^{a diagram} [an illustration] showing one example of an image
20 picked up^d a horizontally elongated object in a setting for horizontal writing;

Fig. 13 is ^{a diagram} [an illustration] showing one example of an image
picked up^{of} a vertically elongated object in a setting for vertical writing;

Fig. 14 is ^{a diagram} [an illustration] showing an overall construction
25 of a process designating device;

Fig. 15 is ^{a diagram} [an illustration] showing one example of the case when an erroneous object is designated by the video pen;

Fig. 16 is ^{a diagram} [an illustration] showing an example ^{of the} detecting, ^d overlapping of the penpoint and the object after extraction

5 of the object;

Fig. 17 is ^{a diagram} [an illustration] showing one example of a screen, ⁿ teaching a manner of pointing;

Fig. 18 is ^{a diagram} [an illustration] showing one example of a message displaying pointing correction means;

10 Fig. 19 is ^{a diagram} [an illustration] showing one example of a sheet used for pointing correction;

Fig. 20 is ^{a diagram} [an illustration] showing one example of an image picked-up ^d a standard pattern for pointing correction;

Fig. 21 is ^{a block diagram} [an illustration] showing ^{the} [an] internal
15 construction of an image processing apparatus;

Fig. 22 is ^{a diagram} [an illustration] showing [an example of the case] where a horizontally elongated object as one example of a binary image;

Fig. 23 is ^{a diagram} [an illustration] showing one example of a value
20 for pointing correction;

Fig. 24 is ^{a diagram for illustrating the use of} [an illustration for explaining a] pointing correction data;

Fig. 25 is ^{a diagram illustrating} [an illustration for explaining] object extraction;

25 Fig. 26 is ^{a diagram} [an illustration] showing one example of an image of the extracted object;

Fig. 27 is ^{a diagram illustrating} [an illustration for explaining a] tilt correction;

Fig. 28 is ^{a diagram} [an illustration] showing one example of an image of ^{an} object after tilt correction;

5 Fig. 29 is ^{a diagram} [an illustration] showing one example of a characteristic amount;

Fig. 30 is ^{a diagram} [an illustration] showing one example of a structure of a pattern dictionary;

10 Fig. 31 is ^{a diagram} [an illustration] showing one example of a structure of a process table;

Fig. 32 is ^{a diagram} [an illustration] showing one example of a structure of a operation table; and

Fig. 33 is ^{a diagram} [an illustration] showing one example of a display image of the information processing apparatus.

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BEST MODE FOR IMPLEMENTING THE INVENTION

Fig. 1 shows one example of a hardware construction for implementing the present invention. A user may input data to an information processing apparatus 102 ^{to} [and] execute a command of the information processing apparatus 102 employing a pen type input device ^{on which} [mounting] a compact camera 101 ^{is mounted}.

20 Such ^a pen type input device with ^a [the] camera will be referred ^{to} hereinafter as a video pen 103. When a user points ^{using} [by] something the video pen 103, a switch mounted at the tip end of the video pen 103, namely a penpoint switch 104, is turned ON. The information processing apparatus 102 is responsive to ^{the} turning

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ON of the penpoint switch 104 to take ⁱⁿ the image from the camera 101 of the video pen 103, ^{so as} to execute various processes depending upon the content ^{of the received data}. For example, a line in a document is extracted from the image, subject to character recognition, ^{the data is transferred} and ^(transfers) to a dictionary program. Then, the result is displayed on a display 105.

Fig. 2 shows one example of ^{the} (a) structure of the video pen 103. A penholder 201 ^{is} (is a) portion ^{to be} gripped by the user. A penpoint switch 104 is mounted on the tip end of the penholder 201. The tip end of the penpoint switch 104 ^{has a} (is) bar-shaped configuration. When the user points ^{to an} (the) object ^{using} (by) the video pen 103, the bar is pushed into the penholder 201 to turn ON ^{an} (the) electrical contact. ^{On} (To) the penholder 201, the camera 101 is mounted so as to pick-up ^{an} image ^{of the area} around the tip end ^(portion) of the video pen 103. The camera is mounted on the penholder 103 by a camera holding member 202. The camera 101 is mounted ^{where it is able} at a position ^{on} to vertically look down ^a portion around the tip end as much as possible when the user holds the video pen in ^{typical} a manner ^{of} holding ^a (the) pen. As the camera 101, a commercially available compact video camera may be used. The compact ^(vide) video camera employing a 1/4 inch ~~mm~~ image pick-up element has a circular cross-section less than or equal to 1 cm in diameter ^{and} a length of about several cm. On the other hand, the penholder 201 ^(is) ^{has a} circular bar-shaped cross-section about 1 cm in diameter similar ^a to typical pen.

Fig. 3 shows a ^{view} (case) looking down from the right above

with [raising] the video pen 103 ^{oriented} in the same condition as that ^{in which} the user holds the same. In ^{this} [the] case, since the camera 101 is arranged in ^a vertical direction, it can be seen in circular form as in [the] cross-section. Here, the point to notice is that the penholder 201 and the camera 101 are ^{not} arranged on the same ^{plane} [plain]. The camera 101 is arranged ^{to be} offset ^{toward the} upper left direction from the ^{plane in} [plain] on which the penholder 201 falls. ^{When} ^{to a} [upon] pointing ^{the} [line of the] vertical ^{line in a} document ^{using} [by] the video pen 103, this ^{orientation will} [is] ^{for consideration for} prevent ~~the~~ the objective line from being

10 hidden by the penholder 201.

Fig. 4 shows an example of the image of [the picked up] ^{a horizontal} line in ^a [the horizontal writing] document ^{picked up} by the video ^{pen} [pin] 103 shown in Fig. 2. A penpoint 401 of the video pen 103 appears at a position slightly offset ^{in a} [to] lower right direction from

15 the center of the image. On the other hand, at a center portion, ^{the} objective pattern 402 pointed ^{to} by the user is picked up.

^{a vertical} [On the other hand,] Fig. 5 shows an example of the image of ^a [the] line in [the vertical writing] document picked up by the video pen 103 shown in Fig. 2, similarly. The penpoint 401 of

20 the video pen 103 appears at the same position as that in Fig. 4. This is natural since the positional relationship of the camera 101 and the penholder 201 is fixed. In Fig. 5, the objective pattern 501 appears to extend vertically at the center of the image. At this time, since the camera 101 is arranged ^{so as to be} offset ~~the~~ ^{the} toward ^{obstructs} left from the penholder 201, the penholder 201 never ^{so as} [interferes] the camera to hide the objective pattern

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line of the
501 in the vertical writing document.

Fig. 6 shows a method for installing the camera upon forming the video pen 103 for left handed ^{use} similar ~~to~~ to Fig. 3. In the video pen 103 ^{arranged for} [shown in Fig. 3] is ^{to a} [premised in] right handed operation and is assumed to point ^{when held the} the vertically elongated object ^{by} by right hand from ^{the} right side. In order to point ^{to} the vertically elongated object ^{using the} by left hand from ^{the} left side, the camera 101 may be installed ^{so as to be} offset ~~from~~ toward ^{the} right from the penholder 201. ^{In way} By this, even when the vertically elongated object is pointed ^{to} from the left side by the video pen 103, the object will never be hidden by the penholder 201.

Fig. 7 shows how much offset from the center ^{plane} [plain] of the penholder 201 is required for the camera 101. ^{In order for the penholder 201 to} [So as] not ^{with} [to] hide the vertically elongated object ^{by} by the penholder 201, the camera 101 has to be offset ⁽ⁱⁿ⁾ a magnitude greater than or equal to half of the thickness 701 of the penholder 201 at the portion picked up by the camera. However, ^{for} ⁽ⁱⁿ⁾ certain shapes of the penpoint 401, ^a [the] smaller offset magnitude ^{will} [can] be sufficient. For example, when ^{the portion of} the penpoint 401, ^{appearing} in a range ^{of} [appearing in] the image of the camera ^{has} [is] the shape as illustrated in Fig. 8, the offset magnitude can be greater than or equal to 0. Accordingly, ^{the} offset magnitude of the camera may be adjusted so that the offset magnitude is greater than the width of the portion of the penholder 201 ^{appearing} in a range [appearing in] ^{of} the image of the camera, ^{relative to} inclined toward the object to be pointed ^(that) the center line of the penholder 201.

Fig. 9 shows another example of the structure of the video pen 103. (A portion) ^{the body} of the pen holder 201 is the same as that shown in Fig. 2, but is, ^{different} [differentiated] in ^{the} mounting [method] of the camera 101.

5 Fig. 10 shows a ^{view} [case] looking down from the right ^{oriented as} [above] with ^{in which} [raising] the video pen 103, shown in Fig. 9 in the same condition as that ^{as opposed to} the user holds the same. In this case, ^{different from} [different from] the case of Fig. 3, the camera 101 is arranged on the same ^{plane} [plain] ^{will} plane with the penholder 201. Accordingly, there ^{to} [would] be ^{a line} [raised] no problem in pointing ^{to a} the object in ^{a vertical} horizontal ^{of a written} [writing]. However, upon pointing ^{with the camera} (the) vertically elongated object, such as ^{problem} a line of (the vertical writing) document, the pen-holder interferes.

For solving this, in the video pen 103 shown in Fig. 9, camera 101 ^{can be} [is] shifted toward ^{the} left with ^{rotation in a range of} [rotating over] 90° with respect to the penholder 201. Fig. 11 shows a condition ^{at an position} locking down the camera 101 ^{the} offset ^{of the camera} toward left with rotation. The camera holding member 202 is bent at ^{an} (the) intermediate position, and the camera is rotated ^{a range of} over 90° to swing out toward ^{the} left. In this condition, upon pointing ^{to a} (the) vertically elongated object, 20 the penholder 201 will never hide the object.

Fig. 12 shows one example of the image ^{picked up by the camera under} (picked up the) of a horizontally elongated object ^{shown in} (in the condition of) Fig. 10. There is no significant difference ^{with} (as) the case of Fig. 4 except for the position ^d (appearing) the penpoint 401 being slightly ^{the} [lower] below 25 [Side of] the center of the image. Namely, upon pointing ^{there is little difference in the pointing of} the horizontally elongated object, it can be said that the video

pen 103 shown in Fig. 2 and the video pen 103 of Fig. 9 [has]
[little difference upon] ^{when} pointing ^{to a} [the] horizontally elongated
object.

On the other hand, Fig. 13 shows one example of the image
5 [picked up the] ^{of a} vertically elongated object ^{picked up by the camera under} [in] the condition [of] ^{shown in}
Fig. 11. In this case, since the camera 101 is rotated over ^{by}
90°, the penpoint 401 appears at ^{below the} [lower] left side of the center
of the image. On the other hand, the vertically elongated object
appears as elongated in ^a horizontal direction of the image. The
10 image picked-up by [the] ^a commercially available video camera is
typically elongated in ^{the} horizontal direction. In the
construction of the video pen 103 shown in Fig. 9 [], even upon
pointing ^{to a} [the] vertically elongated object, the image of the image
pick-up element can be used effectively.

15 Namely, upon pointing ^{to a} [the] vertically elongated object
[by] ^{using} the video pen 103 shown in Fig. 2, only ^{the} object falls within ^{the}
shorter sides of the image, as shown in Fig. 4. However, in ^{the} case
of the video pen 103 shown in Fig. 9, it becomes possible to
input the object ^{which} falls within the longer sides of the image,
20 as shown in Fig. 13.

The video pen 103 shown in Fig. 9 encounters ^{a problem} in that,
upon pointing ^{to a} [the] vertically elongated object, the user has
to change the arrangement of ^{the} camera 101. Accordingly, it is
desirable to employ the construction shown in Fig. 2 when ^{the}
25 resolution and image pick-up range of the camera is sufficiently
large, ^{and} to employ the construction shown in Fig. 9 otherwise.

In the construction of the video pen 103 shown in Fig. 9, so that the information processing apparatus 102 may make^a judgment^{as to} whether the object is horizontally elongated or vertically elongated, it becomes necessary to read where the camera 101 of the video pen 103 is set. This may be done by electrically ^{detecting} [read] the condition of the camera holding member 202 or by making^a judgment from the picked-up image. Namely, by checking where the penpoint 401 appears in the image, the position of the camera 101 can be identified. If the penpoint 10 402 appears at^a central lower side of the image, as shown in Fig. 12, ^{this indicates a} [it is the] ^a case where [the] horizontally elongated object is ^{being} picked up. On the other hand, when the penpoint 401 appears ^{the} at lower left side of the image, as shown in Fig. 13, ^{this indicates a} [it is the] ^{to the} case where the vertically elongated object is pointed^a from right side. Also, when the penpoint 401 appears at lower right side 15 of the image, ^{this indicates a} [it is the] case where the vertically elongated object is ^{being} pointed^{to the} from left side.

In the portion of the penholder 201 of the video pen 103, a process designating device 1401 for designating^{the} kind of [the] process to be^{executed} ^{data obtained from the} [applied] for the [pointed] object is provided. The process designating device 1401 is [such] a mechanism for switching^{the} pen color in a multi-color ball pointed pen, for example. The user selects a color corresponding to the process to be activated by rotating a rotary portion 1402 at the upper end of the penholder 20 201.

By preliminarily setting ^a [the] predetermined process [by] ^{using}

the process designating device 1401, the user may activate the process simultaneously with designation of the object to be processed. The process designation device 1401 may also vary^{the} shape or color of the penpoint 401. Since the penpoint 401 is
5 the portion^{used} to point^{to} the object, the user may watch the shape or color of the penpoint 401 corresponding to the kind of process
[with]^{while} watching the object [to point].

For reading^{the} condition of the process designating device, namely, which one of^{the} pens is selected, a construction employing
10 electrical contacts may be considered, for example. In such^a case, upon turning ON of the penpoint switch 401, the condition of the processing device 1401 may be read out.

On the other hand, since the penpoint 401 falls within the visual field of the camera 101, it may be possible to identify
15 the kind of [the] process by image processing without using^a particular electric signal upon processing the image from the camera 101. Since the positional relationship between the penpoint 401 and the camera is known, the position of the penpoint 401, particularly the pen in the input image from the camera
— 20 101, can be calculated preliminarily. During [process of] the image processing, by checking the color present at the current position,^{the} kind of the currently selected process can be easily discriminated.

In a user interface method according to the present
25 invention, the user inputs^{an image of} the [process] object to the information processing apparatus 102 [by an image] using the video pen 103.

Accordingly, in order to accurately input ^{an image of} the [process] object, it becomes necessary to acquire the correct object designation method ^{using} [by] the video pen 103. Namely, the penpoint 401 of the video pen 103 should not hide the object, and the penpoint 401
5 and the object should not be too distant.

The user, ^{when} using the video pen 103 ^{for} [at] the first time, tends to overlap the penpoint 401 ^{on} [over] the object, as shown in Fig.

15. This condition will not create ~~a~~ a problem when the object to be pointed ^{to a} is displayed image ~~of~~ of the system, such as a pen

10 input computer, and has means ^{to} [for] input coordinates on the display, ^{of the image} pointed by the pen. However, in the user interface method, as ^{employed by} [in] the present invention, when the [pointed] object is extracted from the image by picking up ^a [the] portion around the penpoint 401, it ^{will} ^a (should) be a significant problem ^{is hidden} [to be hidden the pointing] if ^{it} ^{is hidden} object, by the penpoint 401.
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As set forth above, ^{the} [for a measure] in the case where user places the penpoint 401 ^{so that it} overlaps ~~the~~ with the object, it becomes ^{to provide a} necessary means for teaching ^{the} manner of pointing by detecting ^{the} occurrence of overlapping ^{orientation} [placement] of the penpoint ^{on} [over] the
20 object and teaching the correct manner of pointing.

Overlapping of the penpoint 401 ^{on the} [and the pointing] object can be detected in the following manner. Namely, a region extracted as ^{an} object and a region where the penpoint 401 should appear are compared to ^{determine whether} ^{has} [make judgment that] the user placed the ^{so that it} penpoint ^{on} overlaps ^{which is indicated} [with] the object, if both have ^{an} overlapping portion. Fig. 16 shows one example where a region 1601 extracted

as ^{an} object and the projection 1602 of the penpoint 401 overlap.
The region where the penpoint ^{401 is located} (201) can be derived preliminarily,
since the positional relationship between the penholder 201
and the camera is known. Upon detection that the user overlaps
5 the penpoint 401 ^{on the object}, a teaching display ^{which shows} [of teaching] the user the
correct manner of pointing ^{to} the object is displayed. It is also
possible to ^{produce} [display] the teaching display ^{indicating} [of] the manner of pointing
when the failure of extraction of the object ^{has occurred} [is failed] in series
(for the) ^a predetermined ^{number of} times, for example, three times.

10 Fig. 17 shows one example of a teaching image to be displayed
on a display 105 of the information processing apparatus 102.
The pointing manner teaching image teaches [to] the user to point
several mm ^{toward the} lower side in ^{the} case of ^a (the) horizontally elongated
object and several mm horizontally ^{toward the} right side in ^{the} case of ^a (the)
15 vertically elongated object.

On the other hand, in the pointing manner teaching image,
a pointing correction button 1701 is provided for calling the
pointing correcting means, which will be discussed later.

When the user points ^{to} the object ^{with} [by means of] the video
20 pen 103, ^{the} manner of pointing is ^{different for} [variable in] each individual.

For example, upon pointing ^{to a} [the] horizontally elongated object,
some users ^{to} may point ^{to} the lower side of the center of the object,
and another user may point ^{to the} lower right side of the object. Also,

the tilt angle of the pen relative to the object may be [variable] ^{different}
25 [in] ^{for} each user. For example, upon pointing ^{to a} [the] horizontally
elongated object, some users ^{to} may point ^{the} the object from ^{right}

below, and another user may point^{to} the object from the lower right. Furthermore, ^{the} distance from the object to be pointed^{to} and the penpoint 401 may be ^{different for each} variable per user. For example, upon pointing ^{to a} the horizontally elongated object, some user may point
5 immediately ^{to the} lower side of the object and another user may point ^{to a} (the) position about 1 cm below the object.

As set forth above, ^{the} different (of) manner of pointing (of) ^{to} the object, depending on the user, has to be reflected ^{as a} (to) parameter upon extraction of the object [pointed by the user]. Also, in
10 some cases, it may become necessary ^{to} (for) adjust ^{the} positional relationship between the penholder 201 of the video pen 103 and the camera 101. ^{Thus} (Then), in the user interface method according to the present invention, there is provided means for preliminarily registering ^a difference (of) ⁱⁿ pointing by the user
15 (hereby referred to as "pointing"). This means will be referred to as ^a pointing correction means.

Upon activating the user interface method according to the present invention, at first, the pointing correction means is called upon ^{by} depression of the pointing correction button
20 ^{as} 1701 set forth above [and so forth]. The user may register his ^{choice} (favor) ^{use} by [means] of the pointing correction means in the following ^{manner} [matter], for example. When the user activates the pointing correction means, a message ^{as shown} (showing) in Fig. 18 is displayed ^{to} on the display 105. According to the message, the user points ^a
25 the object on ^a pointing correction sheet shown in Fig. 19 [by] ^{using} (means of) the video pen 103. The pointing correction sheet is ^a

^{sheet of} simple paper ^{on which a} ^{is printed} [printed the] horizontally elongated object. The object, shape and the size of the standard pattern 1901 are preliminarily registered in the information processing apparatus 102.

5 When the user points ^{to} the standard pattern 1901 ^{using} [by means] ^{will} (of) the video pen 103, the image shown in Fig. 20 is obtained as the input image. The information processing apparatus 102 ^{indicator} read out information ^{has} what portion of the object ^{at} () the user ^{to with} pointed ^{by} (by) the penpoint 401, and ^{at} what angle ^() the penholder 201 is tilted ^{during} ^{choice} (upon) pointing by performing image processing for the image. 10 The ^(favor) of the user relating to designation of the object thus read out is used as a reference value upon extraction of the object to be processed from the input image by the information processing apparatus 102.

15 In the ^{illustrated} [shown] embodiment, ^{the} (a) distance between the object and the position pointed ^{to} by the user (object minimum distance) and ^{the} tilting ^{angle} (standard tilting) ^{of} the video pen 103 are registered ^{the} as user's ^{choice} (favor). ^{The} ^{this information} Manner of deriving ^(those) (those) will be discussed in detail later together with ^a discussion ^{of the} (for) object extracting 20 portion of the information processing apparatus 102.

Fig. 21 shows one example of the overall construction for implementing the present invention ^() and illustrates ^{the} particular internal construction of the information processing apparatus 102. Hereinafter, ^{the} operation ^{the} of , respective 25 components will be discussed.

(1) Video Pen Interface 2101

When the user points^{to} the object to^{be} input by the video pen 103, the penpoint switch 104 mounted at the tip end of the video pen 103 is turned ON. The video pen interface 2101^{upon detecting the} [detects] turning ON of the penpoint switch 104^{will in} [to] take one frame of^{the} image from the camera 101^{and the image frame} [to] transfer^{to} to a binarizing portion 2102. 5 The image transferred to the binarizing portion 2102 is a color image having 320 dots in^{the} horizontal direction and 240 dots in^{the} vertical direction, and^{it will be converted to a signal} [in] color [number] of 24 bits per one pixel.

On the other hand, the video pen interface 2101 reads 10 in the condition of the process designating device 1401 attached to the video pen 103^{so as data} to write^{to} in the process designating buffer 2103. Data written in the process designating buffer 2103 is^{the} number of the pen selected by the process designating device 1401, for example. However, when^{the} number is 0, it represents 15 the condition that no process is designated.

(2) Binarizing Portion 2102

The binarizing portion 2102 converts the input image into^a binary image^{signal} and transfers the resultant binary image^{signal} to an object extracting portion 2104. Fig. 22 shows one example of^{the image represents} 20 the binarized image^{signal} transferred to^{to} the object extracting portion 2104.

It should be noted that, in the construction where the condition of the process designating device 1401 cannot be read out from the electrical contact, in advance of binarization 25 of the input image^{the}, color of the region where the pen appears is checked to determined what color^{so as} [of] pen is selected^{to} to write

^{the}
the number of pen selected in the process designation buffer
2103.

(3) Object Extracting Portion 2104

The object extracting portion 2104 is a ^{unit} [portion] for
5 extracting the ^{data} [process] object, from the binarized image ^{signal},
transferred from the binarized portion 2102. In the transferred
binarized image ^{signal}, various matters other than ^{the} object appear.
For example, ^{the} penpoint 401 ^{may} appear and matters written near the
object may also appear. The function of the object extracting
10 portion 2104 ^{is to} ^{the data} extract only object from the transferred binarized
^{signal} image. The image ^{signal} is ^{then} transferred to a tilt correcting portion
2105.
^{The user preference,}
[Favor] ^{to} when the user points the object, is stored in the
pointing correction buffer 2112. The content of the pointing
15 correction buffer 2112 is a set of values ^{as} shown in Fig. 23,
^{values} namely, ^{the} a set of object minimum distance 2301 and a standard
tilt 2302. The object minimum distance 2301 is derived with
reference to how much distance is provided between the penpoint
401 and the object when the user points ^{to} the standard pattern
20 1901. The object minimum distance 2301 ^{can be} can be set as
a length (number of dots) of ^a line segment ^{, as seen} D in Fig. 24, for
example. Also, the reference tilt 2302 is a value expressing
how much the user tilts the video pen 103 ^{represent} and can ^{determine} determine
the magnitude of the tilt A in Fig. 24, for example. An initial
25 value of the object minimum distance 2301 is 20, for example,
and the initial value of the standard tilt 2302 is 0, for example.

In case of Fig. 24, the object minimum distance 2301 is 18 dots and the standard tilt 2302 is 32° .

A process^[,] in which the object extracting portion 2104 extracts the object from the binary image will be discussed with reference to Fig. 25. It should be noted that, in the following discussion, the coordinate system ^{on} ~~in~~ the image has ^{its} origin at ^{the} upper left position. On the other hand, the constants used in the following discussion are CAMX representing ^{the} X coordinate of the penpoint 401 in the image, CAMY representing ^{the} Y coordinate, and D representing ^{the} object minimum distance 2301. Since the positional relationship between the penholder 201 and the camera 101 is known, CAMX and CAMY are values derived preliminarily. D is a value which can be read out from the pointing correction buffer 2112, as set forth above.

At first, the object extracting portion 2104 searches the image of the object from ~~(the)~~ a point S (CAMX, CAMY-D), ^{which is} offset ~~upwardly~~ ^{by} ~~in the magnitude of~~ ^{the} D from coordinate (CAMX, CAMY) of the penpoint 401. ^{the image of the object is searched} Namely, ^{along} the line segment L in Fig. 25^[,] the image of the object is searched. At this stage, if any pixel considered as belonging in the object cannot be found, extraction of the object fails. Here, ^{each} ~~found~~ pixel of the object is stored as the object region.

Next, the object extracting portion 2104 checks around the object region and takes ⁱⁿ the pixel within a predetermined distance from the object region in ^a new object region. The predetermined distance is 10 dots, for example. Associat^{ed} ~~ing~~

with this process, the object region is gradually expanded.

The object extracting portion 2104 terminates ^{the} expansion process

at a ^{time} [timing] where no further pixel to be taken is present. At

[a timing where] ^{the time when} the expansion process is terminated, ^{the} aggregate

5 of the pixels stored as the object region is judged as ^{the} object pointed ^{to} by the user.

At a ^{time when} [timing where] the object extracting portion 2104 completes extraction of the object, the extracted object region and the region where the penpoint 401 appears are compared.

10 When both have ^{an} overlapping portion, judgment can be made that the user ^{has} placed the penpoint 401 ^{so that it} overlaps ~~with~~ with the object.

For example, ^{this} ~~it~~ is the case shown in Fig. 16. Accordingly, in such ^a ~~the~~ case, ^{the} pointing manner teaching image is presented to the

user to teach the correct object pointing method. Also, if
15 extraction of the object ^{has} ~~is~~ failed continuously, the pointing manner teaching image is presented to the user to teach the correct object pointing method.

For example, when the foregoing method is applied to the binarized image shown in Fig. 22, a pattern shown in Fig. 26

20 is extracted as ^{the} object. The image ^{signal resulting from the process} [as result of] extraction, is transferred to ^{the} tilt correcting portion 2105.

(4) Tilt Correcting Portion 2105

The tilt correcting portion 2105 is ^{used} for calculation of ^{the} tilt of the object from the image of the object transferred
25 from the object extracting portion 2104 and ^{the} correction thereof.

At first, the tilt correcting portion 2105 calculates ^{the}

tilt of the main axis of the received object. An angle R in Fig. 27 ^{represents the} tilt of the main axis. In the case of the ^{illustrated} (shown), example, the tilt is -28° . This is the tilt of the object in the image picked up by the camera 101.

5 Next, the tilt correcting portion 2105 calculates ^{the} (a) tilt of the object relative to the paper ^{on} which the object is written on the basis of the tilt of the main axis, calculated as set forth above, and the value of the standard tilt in the pointing correcting buffer 2112. This tilt will be referred to as ^{the} actual tilt in the following disclosure. Particularly, ^{the} sum of the tilt of the object in the image and the value of the standard tilt becomes ^{the} actual tilt. In the ^{illustrated} (shown) embodiment, since the tilt of the object in the image is -28° and the standard tilt is 32° , the actual tilt derived therefrom is 4° .

10

15 When the actual tilt is in a range close to 0, e.g. from -45° to 45° , the tilt correcting portion 2105 makes ^a judgment ^{and operates} that the object is horizontally elongated, to rotate the image of the object so that the tilt of the main axis ^{of} (p) the image becomes 0. Accordingly, in case of the example set forth above, 20 the image is rotated over -28° . The image of the object after rotation is shown in Fig. 28. Conversely, when the actual ^{tilt} (tile) is out of the range set forth above, the tilt correcting portion ^a 2105 makes judgment that the object is vertically elongated, ^{and so} the image of the object is rotated so that the tilt of the main 25 axis of the image becomes 90° .

The tilt correcting portion 2105 transfers the image of

the object corrected ^{for tilt,} [the tile] ⁱⁿ as completed, the foregoing process, to a characteristics extracting portion 2106. On the other hand, the image of the object corrected ^{for} [the] tilt is stored in an object holding portion. The object holding portion holds the image, and if ^{an} already held image ^{that image} is present, [it] is abandoned.

(5) Characteristics Extracting Portion 2106

The characteristics extracting portion 2106 is ^{used} for extracting the characteristic amount from the image of the object fed from the tilt correcting portion 2105. The characteristic amount may be ^{the} pixel number included in the object, ^{the} size of ^{the} externally inserted rectangle, ^{the} gravity center position and so forth. These characteristic amounts are used for identifying the object later. One example of the characteristic amount is shown in Fig. 29. An object pixel number PIX-NUM, an object external insertion width BOX-WIDTH, an object external insertion height BOX-HEIGHT, a gravity center X coordinate COG-X, a gravity center Y coordinate COG-Y and so forth form ^{the} characteristic amount. These values are all integers.

The characteristic amount extracted by the characteristics extracting portion 2106 is transferred to an object recognizing portion 2107.

(6) Object Recognizing Portion 2107

The object recognizing portion 2107 is ^{not used} a ^a portion for making ^{as to} judgment, whether the object ⁱⁿ [in] currently ⁱⁿ process is registered or not, using the characteristic amount transferred from the characteristics extracting portion 2106.

The object recognizing portion 2107 compares a plurality of the characteristic amounts registered in a pattern dictionary 2113 and a characteristic amount transferred from the characteristics extracting portion 2106 to check whether ^aclose characteristic amount is present or not. The pattern dictionary 2113 ^S~~is~~ consist^a of a dictionary item number region holding the item number included, and ^apattern dictionary item more than or equal to 0 as shown in Fig. 30. Furthermore, the pattern dictionary item ^S~~is~~ consist^a of a characteristic amount region holding the characteristic amount and an object identification number region. In the ^{illustrated} ~~shown~~ embodiment, as the object identification number stored in the object identification number region, ^anatural number (1, 2, 3, ...) is used.

The object recognizing portion 2107 retrieves the pattern dictionary item having ^a~~the~~ characteristic amount close to the input characteristic amount ^a~~,~~ and transfers the object identification number stored in the object identifying number region of the corresponding item to the operation executing portion 2108. When ^aregistered pattern having ^a~~the~~ characteristic amount close to the input characteristic amount is not found, the object recognizing portion 2107 transfers -1 as the object identification number to the operation executing portion 2108.

(7) Operation Executing Portion

25 The operation executing portion 2108 is a ^a~~portion~~ unit for executing ^a~~the~~ predetermined process on the basis of the object

identifying number transferred from the object recognizing portion 2107. The process content will be discussed hereinafter.

When the object identification number is -1, namely when the input object is not ^{an} [the] already registered pattern, the operation executing portion 2108 reads out the object image stored in the object holding portion, ^{so as} to store ^{it} in the pattern buffer 2109. At this time, when ^{an} image already stored in the pattern buffer 2109 is present, ^{the} newly stored image is added to the right side. The object pattern accumulated in the pattern buffer 2109 is held until ^{it is} used in ^a [the] later process.

On the other hand, when the object identification number is -1, namely, when the input object is not ^{an} [the] already registered pattern, the operation executing portion 2108 reads out the pen number held in the process buffer. When the pen number is 0, nothing is done, and ^{when} the pen number is not 0, the process corresponding to the number is executed. The pen number and operation are ^{correlated using a} [corresponded by the] process table.

The process table ^{is} ~~is~~ consist^S of a process item number region holding the item number included therein, and greater than or equal to 0 of the process designation items, as shown in Fig. 31. The process designation item ^{is} ~~is~~ consist^S of the state region holding the pen number and the process designation region holding the operation to be executed when the number is set. The operation executing portion 2108 ^{is} checks the process corresponding to the number using the process table, when the pen number stored in the process designation buffer

is not 0.

On the other hand, when the object identification number transferred from the object recognizing portion 2107 is not -1, namely, ^{when} the input pattern is ^a ~~(the)~~ ^{that is} pattern already registered,

5 the operation executing portion 2108 checks which operation ~~(is)~~ ^S corresponds to the object identification number to execute the operation.

The operation table ~~(is)~~ ^S consists ^{an} of operation item number region holding ^{an} item number included therein and more than or
10 equal to 0 of operation designation item. The operation designation item ~~(is)~~ ^S consists ^{an} of the object number region holding the object identification number and the operation region holding the operation to be executed upon detection of the object.

The operation executing portion 2108 checks whether ^{an} operation designation item having ^a ~~(the)~~ ^{which is} number the same as the object identification number given from the object recognizing portion 2107 is present in the operation table. If present, the operation region of the corresponding operation designation item is read out and executed.

20 ^{by} ~~(the)~~ ^{an} operation which the operation executing portion 2108 may execute ~~(is)~~ ^S is ^{an} OPEN operation, for example. When the operation to be executed by the operation executing portion 2108 is ^{an} ~~(is)~~ ^{operation} OPEN, the operation executing portion 2108 at first stores the pattern stored in the pattern buffer 2109 in a pattern image file of
25 a given name (e.g. "patterns.bmp"). Next, referring ^{to} a file name or a program name stored ^{at a position} following ~~(to)~~ the operation name OPEN, ^{the}

file is opened or ^{the} program is triggered.

The program activated by the operation executing portion 2108 ^{operates to} (may) read the pattern image file and is used ^{to perform an} (in) arbitrary process. For example, ^{an} image stored in the pattern image file is regarded as ^a character string to attempt character recognition. Also, the program to be triggered by the operation executing portion may use ^{an} arbitrary function of the information processing apparatus. For example, it may be possible to call a function encyclopedia program or a function of a map program loaded in the information processing apparatus 102.

By combining the foregoing, as a program to be triggered from the operation executing portion 2108, a program to perform character recognition of the content of the pattern buffer 2109 ^{so as} to transfer ^{it} to the encyclopedia program to display ^{its} checked meaning, can be realized.

Fig. 33 shows one example of a screen image displayed on the display ^{unit} 105 of the information processing apparatus for implementing the present invention. The image, which the user inputs by means of the video pen 103, is displayed in a process step displaying region. In the process step display region, ^{the} step of processing the input image may be displayed. The right side of the process step display region ^{is} is a system message region. The message from the information processing apparatus to the user is displayed in this region. On the lower side of the screen, there is a pattern buffer region. In the pattern buffer region, the process object which the user pointed ^{to using} (by)

(means of) the video pen 103¹) and the information, ^{which the} processing apparatus 102 stores temporarily^{are} [is] stored.

With the present invention, ^{an} object can be input by ^a natural operation. On the other hand, ^{the} number of operations of the user can be reduced significantly. Furthermore, it ^{is possible to} [can] prevent repeated erroneous object pointing [method] by the user to cause^a disturbance. ^{in the imaging process}